CLAIMS

What is claimed is:

1. An N×N upturned expander for serving a connection request to route k incoming signals, k≤N, and for enabling conditionally nonblocking switching, the upturned expander comprising

a switch defined by a set of connection states and having an array of N input ports with N distinct input addresses and an array of N output ports with N distinct output addresses wherein the k incoming signals arrive at k distinct input ports determining k active input addresses and are destined for corresponding k distinct output ports determining k active output addresses, and

control circuitry, coupled to the switch, for routing the incoming signals from the k distinct input ports to the corresponding k distinct output ports by activating one of the connection states such that the activated one of the connection states accommodates the connection request subject to constraints on the connection request: (1) the k active input addresses are consecutive upon a rotation of the ordering of the N input addresses, and (2) for input ports i and j being connected to output ports p and q, respectively, if i precedes j with respect to the rotated ordering, then q precedes p.

2. The upturned expander as recited in claim 1 wherein N=2 and the switch is a switching cell.

3. The upturned expander as recited in claim 1 wherein the switch is constructed by an N×N k-stage switching network composed of k stages of nodes, an interstage exchange between any succeeding two of the k stages, an input exchange and an output exchange, and wherein each node is filled with another switch.

4. The upturned expander as recited in claim 1 wherein the switch is constructed by an N×N k-stage switching network composed of k stages of nodes, an interstage exchange between any succeeding two of the k stages, an input exchange and an output exchange, and wherein each node is filled with another upturned expander.

5. The upturned expander as recited in claim 1 wherein k=2 and the switch is constructed from a two-stage interconnection network composed of a first stage of nodes being the input nodes and a second stage of output nodes being the output nodes, an interstage exchange, and an input exchange corresponding to the interstage exchange

prepended to the network, and wherein each node is filled with another upturned expander.

6. The upturned expander as recited in claim 1 wherein the switch is constructed from a X2 interconnection network having nodes and wherein each node is filled with another upturned expander.

7. The upturned expander as recited in claim 1 wherein the switch is constructed from a X2 interconnection network having nodes and wherein the nodes are filled with a plurality of other upturned expanders.

8. The upturned expander as recited in claim 1 wherein the switch is constructed from a recursive X2 interconnection network having nodes and wherein each node is filled with another upturned expander.

9. The upturned expander as recited in claim 1 wherein the switch is constructed from a recursive X2 interconnection network having nodes and wherein the nodes are filled with a plurality of other upturned expanders.

10. The upturned expander as recited in claim 1 wherein the switch is constructed from a divide-and-conquer network prepended with a SWAP exchange.

11. The upturned expander as recited in claim 1 wherein the switch is constructed from a recursive X2 interconnection network having nodes and wherein each of the nodes is a cell and each cell is filled with a 2×2 upturned expander.

12. The upturned expander as recited in claim 11 wherein the 2×2 upturned expander is a switching cell.

13. The upturned expander as recited in claim 1 wherein the switch is constructed from a recursive X2 interconnection network of cells with each cell filled with a 2×2 upturned expander.

14. The upturned expander as recited in claim 13 wherein the 2×2 upturned expander is a switching cell.

15. The upturned expander as recited in claim 1 wherein the switch is

constructed from a banyan-type network whose trace and guide are both monotonically increasing and wherein each of the 2×2 nodes of the banyan-type network is filled with a 2×2 upturned expander.

16. The upturned expander as recited in claims from 15 wherein the 2×2 upturned expander is a switching cell.

17. The upturned expander as recited in claim 1 wherein the switch is constructed from a recursive 2-stage interconnection network of cells prepended with a SWAP exchange and wherein each cell of the network is a 2×2 upturned expander.

18. The upturned expander as recited in claim 17 wherein the 2×2 upturned expander is a switching cell.

19. A method for constructing an N×N upturned expander to serve a connection request to route k incoming signals, k≤N, the method comprising

configuring a switch defined by a set of connection states and having an array of N input ports with N distinct input addresses and an array of N output ports with N

distinct output addresses wherein the k incoming signals arrive at k distinct input ports determining k active input addresses and are destined for corresponding k distinct output ports determining k active output addresses, and

routing the incoming signals from the k distinct input ports to the corresponding k distinct output ports by activating one of the connection states such that the activated one of the connection states accommodates the connection request subject to constraints on the connection request: (1) the k active input addresses are consecutive upon a rotation of the ordering of the N input addresses, and (2) for input ports i and j being connected to output ports p and q, respectively, if i precedes j with respect to the rotated ordering, then q precedes p.

20. The method as recited in claim 19 further including, prior to routing, activating one of the connection states in response to the connection request.

21. The method as recited in claim 19 further including, prior to activating, selecting one of the connection states in response to the connection request.